

GENERALIZATIONS OF BERNOULLI NUMBERS AND POLYNOMIALS

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and LOKENATH DEBNATH

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The concepts of Bernoulli numbers B_n , Bernoulli polynomials $B_n(x)$, and the generalized Bernoulli numbers $B_n(\alpha, b)$ are generalized to the one $B_n(x; \alpha, b, c)$ which is called the generalized Bernoulli polynomials depending on three positive real parameters. Numerous properties of these polynomials and some relationships between B_n , $B_n(x)$, $B_n(\alpha, b)$, and $B_n(x; \alpha, b, c)$ are established.

2000 Mathematics Subject Classification: 11B68, 33E20.

1. Introduction. It is well known that Bernoulli's numbers and polynomials play important roles in mathematics. They are main objects in the theory of special functions [5]. Their definitions can be given as follows.

DEFINITION 1.1. The numbers B_n , $0 \leq n \leq \infty$, are called Bernoulli numbers if

$$\phi(t) = \frac{t}{e^t - 1} = \sum_{n=0}^{\infty} \frac{B_n}{n!} t^n, \quad |t| < 2\pi. \quad (1.1)$$

DEFINITION 1.2. The functions $B_n(x)$, $0 \leq n \leq \infty$, are called Bernoulli polynomials if they satisfy

$$\phi(x; t) = \frac{t e^{xt}}{e^t - 1} = \sum_{n=0}^{\infty} \frac{B_n(x)}{n!} t^n, \quad |t| < 2\pi, \quad x \in \mathbb{R}. \quad (1.2)$$

The usual definition of higher-order Bernoulli polynomials is

$$\frac{t^\sigma e^{xt}}{(e^t - 1)^\sigma} = \sum_{n=0}^{\infty} \frac{B_n^\sigma(x)}{n!} t^n, \quad |t| < 2\pi. \quad (1.3)$$

In [2, 4] the second and third authors generalized the concept of Bernoulli numbers as follows.

A Generalization Of The Bernoulli Numbers

Ensheng Dong



A Generalization Of The Bernoulli Numbers:

A Generalization of the Bernoulli Numbers Hasmiah Bahari, 2006 *A Classical Introduction to Modern Number Theory* Kenneth Ireland, Michael Ira Rosen, 1990-09-07 This well developed accessible text details the historical development of the subject throughout It also provides wide ranging coverage of significant results with comparatively elementary proofs some of them new This second edition contains two new chapters that provide a complete proof of the Mordel Weil theorem for elliptic curves over the rational numbers and an overview of recent progress on the arithmetic of elliptic curves

Bernoulli Numbers and Zeta Functions Tsuneo Arakawa, Tomoyoshi Ibukiyama, Masanobu Kaneko, 2014-07-11 Two major subjects are treated in this book The main one is the theory of Bernoulli numbers and the other is the theory of zeta functions Historically Bernoulli numbers were introduced to give formulas for the sums of powers of consecutive integers The real reason that they are indispensable for number theory however lies in the fact that special values of the Riemann zeta function can be written by using Bernoulli numbers This leads to more advanced topics a number of which are treated in this book Historical remarks on Bernoulli numbers and the formula for the sum of powers of consecutive integers a formula for Bernoulli numbers by Stirling numbers the Clausen von Staudt theorem on the denominators of Bernoulli numbers Kummer's congruence between Bernoulli numbers and a related theory of p adic measures the Euler Maclaurin summation formula the functional equation of the Riemann zeta function and the Dirichlet L functions and their special values at suitable integers various formulas of exponential sums expressed by generalized Bernoulli numbers the relation between ideal classes of orders of quadratic fields and equivalence classes of binary quadratic forms class number formula for positive definite binary quadratic forms congruences between some class numbers and Bernoulli numbers simple zeta functions of prehomogeneous vector spaces Hurwitz numbers Barnes multiple zeta functions and their special values the functional equation of the double zeta functions and poly Bernoulli numbers An appendix by Don Zagier on curious and exotic identities for Bernoulli numbers is also supplied This book will be enjoyable both for amateurs and for professional researchers Because the logical relations between the chapters are loosely connected readers can start with any chapter depending on their interests The expositions of the topics are not always typical and some parts are completely new *Combinatorial Number Theory* Bruce M.

Landman, Florian Luca, Melvyn Nathanson, Jaroslav Nešetřil, Aaron Robertson, 2024-11-04 This volume consists of twenty articles stemming from presentations given at the 2023 Integers Conference They represent a variety of active areas of research in combinatorial number theory including additive number theory multiplicative number theory elementary number theory the theory of partitions Ramsey theory sequences algebraic combinatorics enumerative combinatorics and Diophantine equations **Bernoulli Numbers** Albert John Coleman, Karl Dilcher, Ladislav Skula, Paulo Ribenboim, 1991

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Applications of Fibonacci Numbers Fredric T. Howard, 2004-02-29 This book contains 28 research articles from among the 49 papers and abstracts presented at the Tenth International Conference on Fibonacci Numbers and Their Applications These articles have been selected after a careful review by expert referees and they range over many areas of mathematics The Fibonacci numbers and recurrence relations are their unifying bond We note that the article Fibonacci, Vern and Dan which follows the Introduction to this volume is not a research paper It is a personal reminiscence by Marjorie Bicknell Johnson a longtime member of the Fibonacci Association The editor believes it will be of interest to all readers It is anticipated that this book like the eight predecessors will be useful to research workers and students at all levels who are interested in the Fibonacci numbers and their applications March 16 2003 The Editor Fredric T Howard Mathematics Department Wake Forest University Box 7388 Reynolda Station Winston Salem NC 27109 xxi THE ORGANIZING COMMITTEES LOCAL COMMITTEE INTERNATIONAL COMMITTEE Calvin Long Chairman A F Horadam

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Table of Contents A Generalization Of The Bernoulli Numbers

1. Understanding the eBook A Generalization Of The Bernoulli Numbers
 - The Rise of Digital Reading A Generalization Of The Bernoulli Numbers
 - Advantages of eBooks Over Traditional Books
2. Identifying A Generalization Of The Bernoulli Numbers
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an A Generalization Of The Bernoulli Numbers
 - User-Friendly Interface
4. Exploring eBook Recommendations from A Generalization Of The Bernoulli Numbers
 - Personalized Recommendations
 - A Generalization Of The Bernoulli Numbers User Reviews and Ratings

- A Generalization Of The Bernoulli Numbers and Bestseller Lists
- 5. Accessing A Generalization Of The Bernoulli Numbers Free and Paid eBooks
 - A Generalization Of The Bernoulli Numbers Public Domain eBooks
 - A Generalization Of The Bernoulli Numbers eBook Subscription Services
 - A Generalization Of The Bernoulli Numbers Budget-Friendly Options
- 6. Navigating A Generalization Of The Bernoulli Numbers eBook Formats
 - ePub, PDF, MOBI, and More
 - A Generalization Of The Bernoulli Numbers Compatibility with Devices
 - A Generalization Of The Bernoulli Numbers Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of A Generalization Of The Bernoulli Numbers
 - Highlighting and Note-Taking A Generalization Of The Bernoulli Numbers
 - Interactive Elements A Generalization Of The Bernoulli Numbers
- 8. Staying Engaged with A Generalization Of The Bernoulli Numbers
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers A Generalization Of The Bernoulli Numbers
- 9. Balancing eBooks and Physical Books A Generalization Of The Bernoulli Numbers
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection A Generalization Of The Bernoulli Numbers
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine A Generalization Of The Bernoulli Numbers
 - Setting Reading Goals A Generalization Of The Bernoulli Numbers
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of A Generalization Of The Bernoulli Numbers
 - Fact-Checking eBook Content of A Generalization Of The Bernoulli Numbers
 - Distinguishing Credible Sources

13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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